thin iron plate in front of this magnet. These experiments are worth repeating by those who desire clearer conceptions of the manner of action of that remarkable instrument.

SUN-SPOTS AND TERRESTRIAL MAGNETISM

IN a remarkable article on "La Météorologie Cosmique," which has appeared in the *Annuaire* of the Bureau des Longitudes, for 1878, M. Faye says with reference to the influence of sunspots on the earth's magnetism, that the observations of Cassini "give 1787·25 for the date of the maximum observed then at Paris, whilst the latest observations—those of Mr. Broun, himself at Trevandrum—assign 1870·85 for the epoch of the last maximum. The interval is 83·60 years. On dividing this by 8, the number of periods in this interval, 10·45 years, are found for the duration of the period. That is to say, almost exactly the value already found by Lamont by means of his own observations at Munich. The period of the spots deduced by M. Wolf, 11·1 years, not being equal to that for the magnetic variations, these two phenomena have no relation to each other."

I desire to offer a remark on this conclusion, which seems to me too hasty. On examining the two periodic series, that for the diurnal variation of declination and that for the frequency of the solar spots, we see that there is a perfect coincidence in their phases though the length of successive periods is not constant. We may find a mean length of ten, eleven, or more years, according to the epoch from which the calculation is begun, but we shall always find the same length from both series if we commence at the same date.

It seems to me then that the true way to determine whether there is an intimate connection between the two phenomena is to compare their phases, and see whether the maxima and minima of the one coincide with those of the other. If there is identity in these respects, we must without doubt find the same mean values for the periods.

M. Faye accepts the date 1787·25 as that of a maximum for the oscillations of the declination. If we look then at the curve, Fig. 2, given by him in the article in question, we see that this corresponds exactly with a maximum of sun-spot frequency. In like manner similar coincidences are seen in the epochs deduced from the observations of Arago and others up to the present time when compared one by one with the sun-spot observations of Schwabe, Carrington, Secchi, as well as of those made at Kew. The conclusion seems to me very different from that of M. Faye. We are entitled to apply the rule he has given (p. 634): "If two series of phenomena, however different they may appear at first, follow exactly the same period, they ought to be referred to the same cause."

There is another passage upon which I desire to offer a remark: "Two kinds of meteors exercise a considerable influence on the direction of the magnetic needle, these are the auroræ boreales and the cyclones."

For the first there is a general agreement, but for the cyclones what observations have we which prove any such influence? If cyclones exercise a considerable influence on the direction of the needle, in what phase of the phenomenon does this occur? Is it on their formation, on their passage over some particular meridian, or when their centre is over a place? In the last case each cyclone will be a source of disturbance, which will be manifested as it progresses, and not simultaneously at all places, which, however, is what really occurs in the case of magnetic disturbances. Electricity is, without doubt, a cause, but only in the case of such considerable discharges as the aurora polaris; but not the local electricity which may accompany cyclones. When there is a storm, and the thunder rolls, and the electrometer shows enormous variations of atmospheric electricity, changing sign continually, the magnetic needle continues its usual and regular progress. Of this we can offer hundreds of examples.

JOAS CAPELLO

Lisbon, February 22

P.S.—The mean movements of the magnetic needle in the Lisbon Observatory, from eight A.M. to two P.M. are given in NATURE, vol. xiii. p. 448, for the years 1858 to 1875; the following are the corresponding mean ranges for the next two years:—

1876 ... ... 5·81′ 1877 ... ... 5·54′

So that the mean movement was less in 1877 than in 1876.

OUR ASTRONOMICAL COLUMN

NEW COMPANION TO ALDEBARAN.—Mr. S. W. Burnham notifies his discovery with the 18½-inch Alvan Clark refractor of the Dearborn Observatory, of a minute star much nearer to Aldebaran than that which makes the double star H. VI. 66; he compares it with the ruddy bright star, as resembling, in difficulty and appearance, Mars and his outer satellite. The mean of three days' observations gives the angle 109°·0, and the distance 30″·35 for 1877·90, or if the second result which, as printed, differs nearly ten degrees from the other two, the angle will be 111°·9. The secular proper motion of Aldebaran, according to Mädler, is 19″·1 in the direction 157°; some years must elapse before the question of physical or optical duplicity can be decided. Eight days' measures of the close companion of Sirius, by Mr. Burnham, with the same instrument, assign for the angle of position 52°·4, distance 10″·83 at the epoch 1877·97.

THE STAR LALANDE 37813.—Mr. J. E. Gore writes from Ballisodare, Co. Sligo, with reference to this star, which appears in the reduced catalogue as a *second* magnitude, and which, observing in the Punjab in August, 1877, he had found a little less than Lacaille 8308 or 7 m. This is one of the errors in the catalogue which, as in a case recently noticed in this column, can only be cleared up by referring to the *Histoire Céleste*. The observation was made on August 20, 1795, and the star No. 37813 was really estimated 7·8 m. α Aquilæ was observed immediately before it, and entered 2 m.; it is this erroneous magnitude for the bright star of Aquila that has become attached to the star of which Mr. Gore writes. There is a very noticeable proper motion in N.P.D., apparently about + 0″·48 annually, as shown by comparison of the observations of Lacaille, Lalande, Jacob, and Argelander, with the position in the Washington Catalogue for 1860.

THE MINOR PLANETS.—Discoveries in this group still progress. No. 186 was detected by M. Prosper Henry at Paris, on April 6, shining as a star of 11·5 m., and No. 187 by M. Coggia at Marseilles, on April 10; it was estimated 10 m. No. 178 (Palisa, 1877, November 6) has been named *Belisana*, and No. 184 (Palisa, 1878, February 28) it is proposed to call *Deiopeia*. With already *seven* additions to the list, it would not appear that 1878 is likely to fall short of the most prolific of preceding years in these discoveries.

THE TRANSIT OF MERCURY ON MAY 6.—If we calculate strictly from Le Verrier's tables of sun and planet, using therefore the value of the sun's diameter which he deduced from the transits of Mercury in his memoir, printed as an addition to the *Connaissance des Temps* for 1848, we shall have the following formula for determining the time of the first *external* contact of limbs in the approaching transit:—

$$t = 3\text{h. } 13\text{m. } 1\text{s.} - [1{\cdot}8723]\, r \sin l - [1{\cdot}9079]\, r \cos l, \cos (L - 56^\circ\, 49'{\cdot}3)$$

in which t is the Greenwich mean time of contact, r the

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radius of the earth at the place for which we are computing, *l* its geocentric latitude, and L the east longitude from Greenwich; the quantities within square brackets are logarithms.

At the Royal Observatory the first external contact is found to occur at 3h. 11m. 35s; the sun will set at 7h. 31m., about 30m. after least distance of centres, so that more than half the transit may be observed. At Edinburgh the first contact takes place at 2h. 58m. 53s. Edinburgh mean time, and the sun will set at 7h. 36m. The first *internal* contact at Greenwich and Edinburgh occurs 3m. 7s. later. The angle from North point of external contact is 45° towards East for direct image.

At Ogden, Utah, to which position it has been stated that a French Expedition is proceeding for the observation of the phenomenon, Mercury enters upon the sun's disc at 7h. 44m. A.M., and the egress takes place at 3h. 18m. P.M., the duration of the transit being 7h. 34m.

At the next transit at the descending node on May 10, 1891, the last external contact at Greenwich, according to Leverrier's tables, will occur at 4h. 50·4m. A.M., and as the sun will not rise till 4h. 19m., but little of the transit can be witnessed in this country. In the transit at the opposite node on November 10, 1894, the first contact of limbs appears to fall close upon sunset here. On November 7, 1881, as will be seen from the *Nautical Almanac*, the transit will be wholly invisible in England. It thus follows that on the afternoon of May 6 next, we shall have in these islands the only favourable opportunity of viewing the planet Mercury projected upon the sun's disc that is afforded during the present century.

GEOGRAPHICAL NOTES

AFRICA.—M. F. Deloncle, a member of the Geographical Society of Lyons, has recently translated into French a remarkably interesting itinerary of the voyages made by a Spanish friar in the middle of the fourteenth century. The work was originally written in the Catalonian dialect and devoted chiefly to travels in Africa.

The Society of Geography has prepared, for the Paris Exhibition, a map of Africa, measuring 2 m. × 2 metres, and showing the route of every explorer from 1754 to Stanley, in 1878. The number of travellers is 121, of whom not less than 42 are French; but a large number of these explored either Madagascar or the Desert round Algeria. The first name written in this list is Mayeur, a traveller now quite forgotten, who crossed the northern part of Madagascar.

NEW MEXICO.—During the season of 1877 a party of the U.S. Geographical and Geological Survey of the Territories, under the command of Lieut. C. C. Morrison, was detailed to survey the section of New Mexico lying between the 105th and 108th meridians and between the 33rd and 35th parallels, about half of which is mountainous, the rest being mesas and plains. In giving an account of their explorations at the last meeting of the Royal Geographical Society, Mr. T. W. Goad, the meteorologist of the party, mentioned some points in regard to the physical features and characteristics of the country surveyed, which attracted special notice. Between the Sierra Blanca and the Oscura Mountains a lava flow was met with of over seventy-five miles in length, with an average breadth of three miles. This Mal Païs, as the Mexicans call it, resembles a black river, widening and narrowing as the country undulates. This stretch of lava, owing to denudation, is somewhat higher than the surrounding country, and is full of caverns. Several of these were visited by the survey party, but the only one of importance was near Fort Stanton, which, like the others, was in a limestone formation, and proved of considerable length; some persons, indeed, asserted that no one had been to the end, though a distance of five miles was measured. The exploration of this cave was of a most uncomfortable nature, necessitating long crawls through narrow passages, and obliging the explorers to wade up to their waists in ice-cold water for hours. Stalactites and stalagmites of immense size were met with. The lake in the cave was said to contain eyeless fish, but none of the party were able to catch or see any. The cañon, again, of the Rio Grande, below Castilla, is of peculiar interest, because it differs in most respects from other cañons, and instead of being worn away by the action of the water alone, it was probably commenced by volcanic action. The sides are of trap-rock, and although the cañon itself is very narrow, its depth was estimated at 1,000 feet. The river at this point has a great fall and rushes along with a velocity of ten miles an hour. Mr. Goad describes the climate of New Mexico as delightful.

GEOGRAPHICAL ANNUAL.—The new volume of *L'Année Géographique*, for 1876, has at length appeared. The delay has been caused by the resignation of the editorship by M. Vivien de St. Martin, whose time is now so fully occupied with other work. The new editors are MM. Maunoir and Duveyrier, and the new volume is quite up to its predecessors. The volume for 1877 will be published about June.

METEOROLOGICAL NOTES

METEOROLOGY OF STONYHURST.—The results of the meteorological and magnetical observations at Stonyhurst for 1877 are already published. In addition to the very full statement of the results for the year, and which are compared with the averages of previous years brought down to date, there are given observations of crops, flowers, trees, and shrubs; observations of the cirrus clouds made at the observatory in connection with Prof. Hildebrandsson's large inquiry into the upper movements of the atmosphere; and a discussion of the hours of occurrence of the barometric maxima and minima during the eight years ending 1875. This discussion has been evidently conducted with great care and with full knowledge of the subject in hand. The results arrived at are of great importance, the chief points being that there is a tendency of the maxima to occur between 10 and 11 A.M. and P.M., the total number from midnight to noon being, however, considerably in excess of that from noon to midnight; and that the minima occur with nearly the same regularity as the maxima, but at different hours, viz., about 3 and 4 A.M. and P.M. The importance of these results lies chiefly in the circumstance that they accord with the hours of the critical phases of the diurnal fluctuations of the barometer, and peculiarly so as regards the annual results. We are much pleased to see from the report that Father Perry is engaged with the discussion of the meteorological observations made at Kerguelen during the Transit of Venus Expedition, to the results of which meteorologists will eagerly look forward.

WEEKLY STATISTICS OF THE WEATHER.—The Meteorological Office has begun to issue weekly statistics of the weather of the British Islands for agricultural and sanitary purposes. For this object the country is divided into two divisions, the one being suited for the production of wheat, and the other for the rearing of stock. For each of the ten regions into which these two divisions are sub-divided there are published the highest, the lowest, and the mean temperature of the week, and the degree to which the last is above or below the average of the week, together with the number of days of rainfall, its amount, and the difference between the latter and the average rainfall of the week. To these follow general remarks on the weather as regards frost, winds, storms, and any irregularity that may have occurred in the rainfall at the selected stations. This step is in the right direction, and the scheme will no doubt soon receive greater extension and further development in order that

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